

## Original article

## I'd do it again in a heartbeat: Coalbed methane development and satisfied surface owners in Sheridan County, Wyoming

Kathryn Bills Walsh\*, Julia H. Haggerty

Resources and Communities Resource Group, Earth Sciences Department, Montana State University, P.O. Box 173480, Bozeman, MT 59717, USA



## ARTICLE INFO

## Keywords:

Oil and gas development  
Split estate  
Surface owners  
Social acceptability

## ABSTRACT

The geographic extent and surface footprint of onshore oil and gas development in the United States have greatly expanded since the mid-1990s, prompting a new set of academic questions and public debates about the social acceptability of the industry. We explore an under-examined phenomenon in the research on the social acceptability of oil and gas industries, that of landowner acceptance and satisfaction with development. We examine a group of split estate surface owners who hosted coalbed methane development (CBM) during the 1998–2008 CBM rush in Wyoming's Powder River Basin. Drawing on semi-structured interviews with surface owners and oil and gas attorneys in Sheridan County, Wyoming, we learn that positive *post facto* assessments of the CBM boom were linked to landowner implementation of diverse but related strategies connected to their private participation in planning for development. We find that private participation during exploration, regarding legal negotiations, and monitoring during development were most closely linked with eventual satisfaction. However, no two surface owners implemented the same strategies, indicating that there are diverse paths to satisfaction. Findings suggest that greater attention be paid to the individual experiences of landowners to further clarify the challenges and opportunities for hosting extractive industries on private lands.

## 1. Introduction

The geographic extent and surface footprint of onshore oil and gas development in the United States have greatly expanded since the mid-1990s (Allred et al., 2015; Trainor et al., 2016), prompting a new set of academic questions and public debates about the social acceptability of the industry in locations that host extraction (Boudet et al., 2016). The extensive geographies of oil and gas development mean that contemporary oil and gas landscapes include a wide array of constituent socioeconomic and physiographic circumstances—from cities to suburbs to farmlands, from regions with no previous experience with fossil fuel development to areas with longstanding histories of economic dependence on extractive industries. This variety has stymied the search for overarching explanations of when, why and how the individuals and residents of oil and gas landscapes resist or accommodate extractive industries—explanations that are an important to understanding opportunities and challenges in the search for sustainable and just energy futures (Sovacool et al., 2017).

In this paper, we explore an under-examined phenomenon in the research on the social acceptability of oil and gas industries: that of landowner acceptance and satisfaction with development. Our study is instructive because of its paradoxical nature: it involves satisfied

landowners in split estate property regimes, a constituency that previous literature—and the logic that individual economic benefits drive social acceptability—suggests would be intolerant of or dissatisfied with energy development (Collins and Nkansah, 2015; Malin, 2014). In split estate property regimes, mineral and surface property rights are separate and typically owned by distinct entities where surface owners can experience much of the disruption while reaping few of the direct financial benefits of extraction (Haggerty et al., 2018).

This study focuses on a group of surface owners who hosted coalbed methane (CBM) development during the 1998–2008 CBM rush in Wyoming's Powder River Basin, a development that followed a classic boom-bust cycle (Gilmore, 1976). The CBM bust in the Powder River Basin included widespread facility 'orphaning' as companies declared bankruptcy and reneged on reclamation obligations (Walsh, 2017), leaving a massive cleanup legacy that state authorities have struggled to manage (Storror, 2015). The unresolved legacy issues in the Powder River Basin might logically increase negative perceptions of oil and gas activity. Yet, despite this and despite their status as surface owners in a split estate regime, the landowners featured in this article emerged with positive assessments of CBM's impacts nearly a decade into the bust, when the research for this study was undertaken.

CBM in Wyoming is unique in comparison to other unconventional

\* Corresponding author.

E-mail addresses: [Kathryn.bills@montana.edu](mailto:Kathryn.bills@montana.edu) (K.B. Walsh), [Julia.haggerty@montana.edu](mailto:Julia.haggerty@montana.edu) (J.H. Haggerty).

oil and gas resources, largely due to the local host geology and extractive process. In the Powder River Basin, the Fort Union coal formation, where coal thickness varies between 50–215 feet, is home to methane gas. The methane is recovered using shallow wells drilled vertically to less than 2500 feet (Thakur et al., 2014). Coal seams are depressurized by pumping water to the surface to facilitate the escape of gas. Water quality varies throughout the Basin, with particular concern for saline content. For this reason, most waters were disposed of in constructed reservoirs or treated and discharged into local river systems, as opposed to being used for irrigation (Nghiem et al., 2011). It is important to clarify that CBM wells in Wyoming are not hydraulically fractured, though they can be in other CBM plays, like those in Eastern Australia (Batley and Kookana, 2012).

The goal of this report is to illuminate and complicate ideas about social acceptance by emphasizing several under-reported aspects of oil and gas development: the important role of individual action by landowners in the context of limited regulatory oversight and capacity, *post facto* perspectives on energy booms, and the paradoxical phenomenon of surface owner satisfaction. The data informing this study are the transcripts of in-depth, semi-structured interviews with a cohort of satisfied landowners and local attorneys that specialize in landowner-industry negotiations collected in Sheridan County, Wyoming, USA. We take a pragmatic approach based in resource geography to identify the pathways to landowner satisfaction in oil and gas development (Wescoat, 1987). Unlike other studies that use discourse analysis or other qualitative methods to identify cultural or social-psychological explanations for levels of social tolerance of extractive industries (Crowe et al., 2015; Kreuze et al., 2016), this paper has a more functional orientation toward landowner practice. Using grounded theory to code and evaluate interview data, the study asks: 1) How do satisfied surface owners experience the lifecycle of CBM production; and, 2) What actions, decisions, and management strategies do they feel contributed to their reported satisfaction?

The paper begins by reviewing relevant literature on *post facto* assessments of energy impacts, the attitudes, and perceptions of split estate surface owners, and the role of individual action, or ‘private participation’ (Jacquet, 2015), in plans for energy development. An overview of the study area context and methodology follows. The results of the research are presented followed by a discussion of findings in light of the scholarship. A conclusion summarizes the paper and provides direction for future research.

## 2. Landowner experience in the boom-bust and private participation scholarship

### 2.1. Long-term impacts of unconventional fossil fuel development

Energy impacts scholars emphasize the importance of longitudinal perspectives in assessing the local impacts of energy development to understand the magnitude and persistence of development impacts and their transformative local effects (Freudenburg, 1992; Krannich, 2017). The boom-bust-recovery cycle provides a framework for understanding the dynamic nature of communities and the ability for certain indicators and perspectives to ‘bounce-back’ from periods of disruption (Brown et al., 2005). Since CBM in Sheridan County began to wane about ten years ago, the site provides an opportunity to explore *post facto* landowner perspectives on the impacts of extraction and to broaden our understanding of how disruption is experienced over time. This study’s close focus on the details of the development process from a landowner perspective also responds to Jacquet’s (2014) call that a “better knowledge of the longer-term picture will aid communities in planning beyond the immediate booms and busts and to help mitigate the problems and accentuate the benefits of resource development” (p. 8328).

### 2.2. Experiences of split estate surface owners with UFF development

Research shows that the costs and benefits associated with oil and gas booms are unevenly distributed (Jacquet, 2014). Specifically, split estate surface owners are often disproportionately subject to costs (Jones et al., 2013). Split estate describes an ownership configuration in which the surface land and underlying minerals are owned by two separate parties (Fitzgerald, 2010; Ryder and Hall, 2017). The literature that assesses the likelihood of conflict in split estate scenarios indicates that surface owners often feel inferior to owners of the mineral estate (Micheli, 2006; Straube and Holland, 2003). Kulander (2009) asserts that surface owners have traditionally been displeased with the “perceived imbalance of power that mineral owners have over surface owners/users” (p. 417). In part, this is a product of the unique legal requirement in the United States that surface owners must grant mineral developers and federal agents access to the subsurface (Jacquet et al., 2018). Conflicts resulting from this perceived imbalance of power have been documented, with some leading to litigation over issues like produced water discharge, unpaid compensation and surface property damage (Walsh, 2017).

Past studies suggest that split estate surface owners are less satisfied than their counterparts who possess unified estates (Collins and Nkansah, 2015; Malin, 2014). For example, Malin (2014) found, for 47 small-scale farmers who host split estates in the Marcellus Shale of Pennsylvania, that, “most small-scale farmers interviewed felt they had little control over the [leasing] process” (p. 25). Collins and Nkansah (2015) explored the perceptions of split estate surface owners in the Marcellus Shale of West Virginia to learn of the factors that influence surface owner satisfaction/dissatisfaction with drilling outcomes. Of particular relevance, Collins and Nkansah (2015) reported that in comparison to owners of unified estates, split estate owners are in a weaker negotiating position and were less satisfied with the compensation they received from industry. In light of these and other studies, this paper presents a paradoxical case where split estate surface owners adapted to impacts and retrospectively assessed that they had captured more benefits than costs.

In Wyoming, split estate lands are vast: nearly 12 million acres in total (Micheli, 2006). The extent of split estate requires surface owners and mineral developers to negotiate surface-use and damage agreements (SUDAs). In the exploration phase of development, a SUDA is negotiated to determine how the mineral developer can use the surface to access the minerals, specifically detailing well and infrastructure placement, construction requirements and reclamation standards for the final post-extractive phase. In July 2005, the Wyoming Legislature passed the Split Estates Act to clarify and extend protections granted to surface owners (Micheli, 2006). Before the Split Estates Act, SUDAs were commonly drafted between surface owners and mineral developers but were not legally required. The Act mandates that mineral developers compensate surface owners for access, and that surface owners are entitled to additional payment for, “loss of production and income, loss of land value and loss of value of improvements caused by oil and gas operators” (WYO. § 30-5-405(a)(i)). The SUDA details the compensation agreed upon by both parties regarding surface-use payments and any royalty payments if the surface owner controls some of the mineral estate. The requirement that individual surface owners negotiate SUDAs privately with mineral developers prompts further questions about the role of individual action in planning for energy development.

### 2.3. Private participation in the planning of energy projects

In the absence of robust federal regulatory schemes, the governance of oil and gas development is increasingly devolved, falling to states, municipal and county governments, NGOs, and ultimately individuals (Fisk et al., 2017). The phenomenon of private participation, in which “private landowners are increasingly afforded the ability to participate

in the planning and siting of...energy developments through contractual land leasing negotiations” (Jacquet, 2015, p. 231), has received little attention in the oil and gas impacts literature (Bugden et al., 2016). Jacquet (2015) examined private participation in the planning process for wind and natural gas development among landowners using a mail survey distributed in northern Pennsylvania. Findings suggest that “[private] participation appears to increase landowner perceptions of control and information access, and ultimately positive attitudes toward the developments” (p. 231). Jacquet (2015) goes on to explain that through private negotiations, landowners feel more informed about the development, planning and ultimate siting of energy infrastructure. This research builds on the work of Jacquet (2015) and others (Bugden et al., 2016) by examining how private participation may alter perceptions of extraction in the context of the unique and often weak relative position of split estate surface owners.

### 3. Case study: Sheridan County, Wyoming

#### 3.1. Area profile

This paper describes the experiences of surface owners located in Sheridan County in northcentral Wyoming, USA. The 1.6 million acre rural county sits atop the Powder River Basin, one of the most productive geologic basins in the world (U.S. Energy Information Administration, 2017). Thirty-five percent of the surface area in Sheridan County is owned by the federal and state governments and managed as forest and range reserves. With low annual precipitation between 12- to 18-inches (Chapman et al., 2004), agricultural operations tend to focus on range livestock production at extensive scales. According to the 2012 agricultural census, 1.2 million acres of agricultural land in the county was in holdings larger than 2000 acres - the census's largest land ownership bracket (U.S. Census of Agriculture, 2012). In 2016, the population of Sheridan County was 30,200 (U.S. Census Bureau, 2016).

#### 3.2. Energy production in Wyoming

Ranked first for coal and sixth for natural gas production (U.S. Energy Information Administration, 2017), Wyoming exemplifies a resource-dependent economy (James and Aadland, 2011). In 2014, about 50 percent of Wyoming's general fund revenues were from natural resources (U.S. Department of the Interior, 2018). Sheridan County's economy is more diverse and mixes tourism, high-end services targeting amenity migrants and recreationists, and extractive industries and agriculture (Headwaters Economics, 2018). Still, the Powder River Basin region's historic and continued reliance on extractive industries contributes to shared regional heritage in which the legacy of primary industries features prominently (Western, 2002).

Related to the state's longstanding dependence on mineral extraction, state-level politics in Wyoming tend to lean conservative and favor limited government regulation (King, 2014). As a result, during the natural gas boom in the early/mid-2000's, the state had limited regulatory and practical capacity to manage the impacts of development—including land and water use (Barrett, 2008) as well as socioeconomic concerns (Haggerty and McBride, 2016). At the federal level, the Bush administration (2001–2009) strongly encouraged streamlining federal policies to facilitate rapid energy development (Rabe, 2007). This meant local governments and the landowners experiencing oil and gas development had considerable autonomy and responsibility for impact mitigation—a marked example of the “devolved governance” phenomenon under a neoliberal political economy as well as the patchwork nature of U.S. oil and gas regulations (Rabe, 2014).

#### 3.3. Coalbed methane development in the Powder River Basin

The Powder River Basin CBM boom started in 1998. Sustained by rising natural gas prices and generous federal tax incentives, the boom continued for a decade. The activity involved 4925 CBM wells drilled by 55 companies in Sheridan County alone, and over 72,000 permits to drill issued to CBM operators throughout the Powder River Basin (WY Oil and Gas Conservation Commission, 2017a). From 1998–2017, the Powder River Basin produced nearly 1,200,000 Million Cubic Feet (MMCF) of gas from at least 13,500 wells (WYOGCC, 2017a). To access the remote locations of wells in this rural geography, companies had to build new roads, power lines, water and gas transmission pipelines, compressor stations, and surface water reservoirs, with much of the new infrastructure affecting private land.

The 2008 economic downturn and subsequent competition from shale-derived natural gas rendered the region's CBM production uneconomical, leading to widespread bankruptcy and facility abandonment. As a result, a decade later, much of the site reclamation required by law is incomplete. In December 2017, there were 5351 orphaned natural gas wells across Wyoming with one-fifth in Sheridan County (WYOGCC, 2017b).<sup>1</sup> The typical un-reclaimed CBM site contains a series of small fiberglass huts, surrounded by cattle fences, containing the wellhead and associated controls as well as electrical infrastructure. An un-reclaimed access road leads to the site, as do above and below ground power lines while a nearby compressor station sits vacant along with abandoned surface water reservoirs or water discharge points. Weedy and non-native vegetation often infiltrate un-reclaimed sites.

Several context-specific characteristics set the Powder River Basin CBM resource play apart from other natural gas producing regions. Unlike the shale gas wells of the Marcellus in Pennsylvania or the Bakken in North Dakota, CBM wells in the Powder River basin are shallow, with some drilled to a depth of less than 1000 feet. The physical properties of the resource, or CBM's materiality (Bridge, 2009), act to open the resource play to a range of industry operators, from well-capitalized companies to 'mom-and-pop' operations, since upfront costs to drill shallow natural gas wells are low.

The oil and gas industry has a standard framework for describing the lifecycle of an oil and gas field. The framework, with five distinct phases of discovery, exploration, development, production, and abandonment, is often used to delineate discrete engineering challenges and/or investment priorities and opportunities (Tanoh, 2016). The phases also have a social component in that they describe changes in the levels and types of activity that link landowners with industry actors as development proceeds. CBM development in the Powder River Basin unfolded in predictable phases, each defined by key characteristics and differing levels of activity on the well site and surrounding property (Fig. 1). The exception is the abandonment phase, which was essentially interrupted by the bust. The result is a proliferation of orphaned wells and stalled reclamation.

### 4. Methods

This research started with an effort to identify impacts to agriculture from oil and gas and how agricultural operators were attempting to mitigate them. Our interest in capturing effects over the full lifecycle of oil and gas development encouraged the selection of Sheridan County, where the CBM boom-bust cycle had recently transpired. A local community development organization helped to arrange a focus group and five exploratory interviews. From these early engagements, we learned

<sup>1</sup> An orphaned well is defined as, “wells for which the agency [WY Oil and Gas Conservation Commission] is unable to require the responsible party (Owner or Operator) to plug and abandon them and rehabilitate the surface because the responsible party no longer operates in the state, is bankrupt, or is out-of-business” (WYOGCC, 2017b).

### Coal Bed Methane Development Cycle: the Surface Owner Perspective

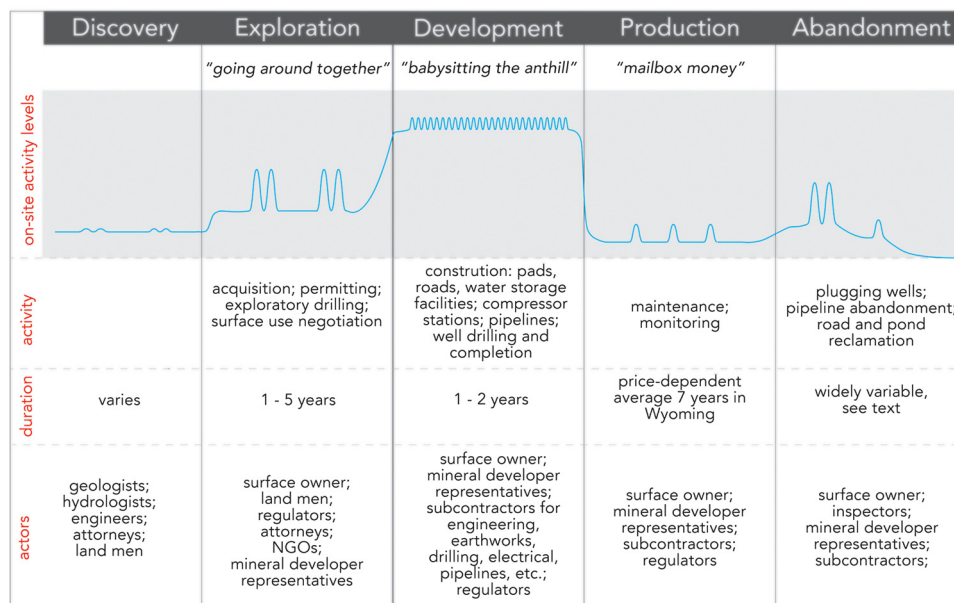


Fig. 1. Coalbed Methane Development Cycle: The Surface Owner Perspective.

that there was a range of *post facto* perspectives on CBM development and that more agricultural landowners had positive experiences with CBM than the literature and media reports had led us to anticipate. This presented an opportunity to learn from a portion of the local stakeholders in oil and gas development who have received less attention than others. The rationale for profiling this group was not that they were representative of the entirety of the CBM experience in Sheridan County. Indeed, there have been some reports in the media of high dissatisfaction with CBM development (Bleizeffer, 2005, 2008). However, our logic is that the specific strategies to manage the disruptive impacts of development used by those with positive *post facto* perspectives could be instructive in two ways. First, the details of how and why a satisfied surface owner can achieve this status shed light on the many things that might go wrong for frustrated surface owners. We also propose that these practical findings can assist surface owners facing similar development to plan for the development lifecycle as a long-term phenomenon.

Our primary sample is made up of five surface owners as well as six local attorneys since legal counsel plays an important role in mediating surface owner's private participation in discussions with industry. We used purposive and snowball sampling to identify landowners that hosted CBM production. To capture diverse perspectives, we specifically requested referrals to surface owners with a range of opinions. We were referred to sixteen landowners, successfully contacted thirteen potential participants, and interviewed a total of ten landowners. In this paper, we report on a subset of five participants from that sample who had shared experiences of satisfaction and had been highly accommodating to industry. The remaining five participants had mixed feelings toward CBM, and no interviewee reported only negative perceptions. Therefore, the entire cohort can be categorized as satisfied. However, we report on the five surface owners who defined their own experiences as almost entirely satisfactory and less mixed.

Satisfaction is based on: (1) the landowner's own overall assessment that the benefits of CBM outweighed costs; (2) that they would be willing to do the CBM experience over again; and (3) a comparison of their experiences to what was shared by the other five participants who reported mixed feelings. Table 1 offers descriptive sample characteristics and serves as a reminder of the large property size and extensive development accommodated by individuals in the sample. The nature of mineral estate ownership varies in the sample as most participants

Table 1

Surface Owner Interview Cohort: Descriptive Characteristics.

Participant	Mineral Estate Ownership	Ranch Size (acres)	Number of CBM Wells	Year CBM Development Began
1	Partial	22,000	300	2000
2	Partial	9,500	67	2005
3	None	30,000	50	2006
4	Partial	3,800	18	2004
5	Partial	1,900	105	2001

have partial ownership of the mineral estate while others do not.

Face-to-face interviews with surface owners followed an open-ended, in-depth format and occurred on the ranch property or at local restaurants between May 2016 and September 2017. Interview questions focused on the history of CBM on their property, their perceptions of development, industry relations, and what informational resources they used. Interviews lasted an average of two hours with the longest interview taking eight hours.

Six local attorneys were purposively recruited to participate in the research based on their expertise in mineral law and legal representation of surface owners. A community partner first referred us to two attorney participants and the remaining four attorneys were recruited via internet searches. Semi-structured interviews lasted an hour and were held at attorney offices, via phone or at public venues in downtown Sheridan, Wyoming. Interview questions addressed each lawyer's understanding of landowner strategies and priorities, industry relations, and natural resource policies in Wyoming.

Interviews were transcribed verbatim and coded with Nvivo 11 Pro. Using a grounded theory approach (Glaser and Strauss, 1967), the data were analyzed using conceptual codes based on the lifecycle of CBM (Fig. 1). Grouping conceptual codes using the phases of CBM development produced themes relevant to the strategies and needs of surface owners during various parts of the cycle. For example, in the exploration phase, codes that emerged include 'negotiating SUDAs,' 'attorney relations' and 'informational resources used.' Ultimately, data analysis concluded with a third and final round of coding for consistency and rigor.



## 5. Results

The following results are organized by the four post-discovery phases of the CBM development lifecycle. This structure focuses attention on the actions, decisions, and adaptations of surface owners as development unfolded. We identify the periods of development that the interview group suggests are most critical to overall satisfaction. The results suggest that early in the operations, during the exploration phase when SUDAs are drafted, and in the development phase when regular monitoring is required, are times when landowner actions may have the greatest consequence. Said best by one landowner:

I had no appreciation [for] the extreme difference [in] the development phases...the difference between development and production is night and day.

### 5.1. Exploration phase

The exploration phase is typically when landowners first encounter industry, often in the form of a 'land man' or teams conducting exploratory geology. When exploratory data are promising, the company initiates the drafting of a SUDA. With a signed SUDA in hand (and all other permits issued by non-landowner entities), development proceeds. Despite the region's long history with extractive industries, CBM involved new techniques and associated infrastructure. Therefore, a key strategy for surface owners as they first engaged with industry was to become educated about CBM development.

Surface owners gathered information from a variety of sources to learn about CBM production. Through coding, we observed a basic distinction in surface owner strategies: whether they were networked or self-sufficient in their approach to learning about CBM. Networked surface owners relied on professional expertise from a local NGO, attorneys and also from friends, family, and neighbors for education and guidance. One networked surface owner remarked:

[The] NGO...accumulated information from their members and from other people of what was going on and what should be done about it, and what attorneys were good...That kept us privy to what was happening and gave us time to think of what we're going to do about it once [the development] got to us.

On the other hand, self-sufficient surface owners relied exclusively on their informal social contacts including friends, family and neighbors and not on expert information from an attorney or an NGO. One self-sufficient participant stated:

I didn't think I needed to pay anybody else for what I thought I could do. I did some research and had friends down in different parts of Wyoming that gave me information on...the different rates...But the legalese is the critical part. A dollar here or there doesn't matter if in the end you can't hold them accountable, if they can wiggle out of [it].

One attorney confirmed the tendency toward self-reliance among Wyoming surface owners:

Ranchers in Wyoming are notoriously closed-mouth. They will help each other brand [cattle], they're friendly, but they generally handle their own business. So as a general statement I would say there's not much discussion, which hurts them. The company dealing with ten different landowners knows what he's offering with each of those ten... But [landowners] don't know, so it puts them at a bit of a disadvantage. Often when they go to an attorney, the attorney knows. So [the attorney] can say you're way low here, we can do better. I can get you this. But I've always advocated that landowners ought to be talking more.

In this assessment, being overly self-reliant can put a surface owner at a disadvantage when negotiating with industry.

Landowners with high self-reported satisfaction all had one characteristic in common: they had a very high or high level of input during the exploration phase. As mentioned, the development of CBM requires the construction of infrastructure projects to service remote well locations. Our sample of surface owners had a very high level of input regarding how the development would unfold. One participant described the experience this way:

We went around, all together, with their crew and the whole outfit, a landman, and we picked out where those [wells] should go...One of them was right down in the bottom of a creek that only ran part of the year. I said you better get out of there; you are going to have some trouble. It doesn't bother me, but I tried to help them, and we got it done fairly well.

Another surface owner shared a similar experience with well siting:

And these wells around these hay meadows, I had a say in every one of those, where they put them because I said you're not going to put those out in the middle of my hay fields...What I told them to do they never had a problem [with].

The surface owners who provided a very high level of input about the placement of wells, compressor stations, roads and surface water reservoirs felt confident the input was meaningful. For example, one participant mentioned that he was approached to explore road siting decisions together with industry:

[They] would ask me to go with [them], if we needed to take a pickup or 4-wheeler and ask me where I'd like to put the roads. [They] pointed to me where [they] needed the wells...So...we built roads, and they all benefited me. To this day we still use those roads.

These examples raise the question of whether input into facility siting resulted from industry representatives being especially cooperative or from landowner assertiveness. The answer is probably both, but that once development begins, industry often had the upper hand. Indeed, careless industry practices could result in unwanted outcomes for landowners. For example, there were instances when input was ignored regarding the placement of pipelines and the failure to reserve topsoil despite it being specifically noted in the SUDA:

In [the SUDA] [industry] are supposed to save the topsoil on roads and everything. I never had...in all the companies, neither one of them ever saved a square cubic foot of topsoil. It's all just dozed over. And that was one thing you just couldn't get them to do...And I suppose we could have gone to court over it or something but short of that we couldn't get anyone to do that.

Our interviews suggest that the most consequential landowner strategy during the exploration phase is his/her approach to the SUDA negotiation. All of the five interviewees satisfied with development worked to exert influence over the SUDA negotiation process – a form of private participation. None of these landowners signed the first SUDA that was proposed by industry. Interviewees reported that industry would pressure them to sign the first SUDA draft. The interviewees noted that the initial draft SUDA was often not in their best interest:

So that took about a year to get [the company] convinced that I wasn't going to back down. That's kind of the way they operate. You know various outfits come in and want you to [decide] in five minutes, and they try to kind of run right over you...I put a stop to that.

An attorney corroborated this point:

Gas companies generally use what's called the producers 88 [contract]. [Companies] all have their own version...it's a form industry has passed around, most of it the same. But if you don't have an attorney and sign that lease, you might negotiate on price as a

layperson...but there's so much more that a knowledgeable oil and gas attorney will negotiate into that SUDA...contractual provisions that [companies] are not going to impose on themselves when they walk up to the front door...and say, 'you want a check for \$100K? Sign here.'

Participants articulated that having detailed knowledge of SUDA terms contributed to their overall satisfaction. Some landowners were intimately familiar with the SUDA because they drafted their own. Alternatively, hiring an attorney to assist with the execution of the SUDA was an important strategy for other participants. In response to an interview question asking about the advice he would pass on to other surface owners, one participant stated:

Well, I would say having a good lease...our attorney put things in legal language that made the lease good. It wasn't a very long one, but we didn't accept the lease that was given to us to just sign by the company. We went through the attorney...that's a really important thing and it is really important to have a SUDA that fits what you want.

A landowner that did not use legal advice expressed that if he were to do it again, he would consult an attorney:

Looking back and going forward I would use an attorney. What I've learned from all this is we've ...got enough wording in there so we could hold [company] accountable. We did really good on our dollar amounts; it's the wording [that] keeps them responsible. Knowing what I know now I would use an attorney.

One surface owner was still very satisfied throughout the lifecycle of CBM development indicating that it is possible, though not advisable, to produce a SUDA without attorney assistance:

The problem I've seen, and I know people that went to lawyers...the oil and gas companies start sending their lawyers in. 'If you're going to deal with a lawyer, [company] are going to deal with a lawyer.' Well, you put two lawyers together and you've got Congress, and nothing gets done.

One attorney acknowledged the possibility of surface owners achieving satisfaction both with and without the help of legal counsel, although he noted that satisfaction is not guaranteed:

There are some very educated, intelligent landowners out there that do their own [SUDA] and probably do a very good job. There's a good share that go to attorneys and a good share that don't. Sometimes they don't sign good deals.

Surface owners articulated that their satisfaction had much to do with their initial actions during exploration. Attorney responses support this finding in their shared emphasis on the importance of landowner involvement in negotiations, encouraging communication between surface owners and, unsurprisingly, promoting the involvement of legal counsel. Ultimately, gathering informational resources, having input in development decisions, and insisting on a carefully drafted SUDA positioned surface owners to best respond and adapt to impacts.

## 5.2. Development phase: the 'anthill'

Following exploration and the successful negotiation of a SUDA, construction of wells and infrastructure on the surface begins. Yet without oversight and enforcement, the SUDA lacks teeth. The satisfied surface owners we interviewed emphasized the importance of active engagement with development during this stage given its chaotic and high impact nature:

[Development] is five different contractors on one job site, electrical contractor, you've got a dirt mover. You've got the guys putting pipes in the ground...all different entities...Three different pick-ups a piece, it is a flurry. It is an ant hill. They go away once things start

producing and then it starts to be quiet.

Coding the descriptions by surface owners of their strategies during the development phase produced three different styles of monitoring construction activities: active, convenience and passive.

Among the five satisfied landowners in this sample, one engaged in an active monitoring approach based specifically on his extensive time investment. He made the 140-mile round trip to the ranch from his primary residence bimonthly (for at least seven years) to monitor CBM activities and encouraged his ranch manager to report any concerns to him. His wife closely tracked payments from industry for accuracy. If a discrepancy was found, they would contact their lawyer to draft an official letter to the company. This surface owner estimated that, together, he and his wife spent 40 h a week monitoring industry activity during the development phase, a time investment enabled by their status as retirees.

Other surface owners pursued a convenience monitoring approach. Three landowners monitored industry activities daily but did so in combination with their daily tasks around the ranch. They did not travel to well sites specifically to check up on industry work. Instead, throughout their daily tasks on the ranch, they would keep an eye on industry activities and visit nearby well locations. One participant said:

I was out there every day, but I also had a job in town...It wasn't a big deal; I was out checking cows or doing whatever anyway. I'd say I'll go over and look and see...uh-oh looks like they have a problem there.

Another surface owner engaged in passive monitoring. The level of monitoring was moderate but not daily. This landowner did not actively worry about industry activities or make efforts to check-up on industry at regular intervals. This is likely a product of this rancher's specific situation as he only had one industry company on his place, and they were a larger, well-capitalized operator. Nonetheless, this surface owner kept watch over industry activities. Interviews suggest that implementation of monitoring strategies in the development phase can take many forms and contributes to landowner satisfaction.

## 5.3. Production phase: the arrival of "mailbox money"

The production phase involves a substantial reduction in on-site activity. Yet, the satisfied surface owners in this study did take particular actions during this phase that they described as important to their satisfaction, specifically in regards to "mailbox money," the surface-use or royalty payments owed to them. Payment negotiations made during the exploration phase of leasing (in the case of mineral owners) and when drafting SUDA terms had implications for satisfaction. For example, one participant stated:

We don't have any minerals, we didn't get one single royalty check but I'm going to tell you it was positive for the operation. Our surface-use payments were substantial, and that helped our cash flow.

When negotiating his SUDA, another surface owner adhered to a flat-fee payment approach which he assessed as mutually beneficial to himself and the industry company:

It turned out the surface damage payments were \$110,000 a year, and hey [the company] liked that because they knew what their costs were going to be. They didn't have to fight with the landowner.

As both infrastructure acquisition and monetary compensation contributed to satisfactory *post facto* assessments, actions to negotiate payments are evaluated as critical.

## 5.4. Abandonment phase: who's on the hook?

The abandonment phase should represent an uptick in on-site activity as industry operators work to plug and abandon wells and

conduct site reclamation as required by law and the terms of the SUDA. However, activity largely came to a halt in Sheridan County with the bust, leaving a set of un-reclaimed, orphaned facilities. For this reason, this dataset mostly emphasizes the complicated nature of landowner ‘satisfaction’ with reclamation and abandonment. Among the satisfied landowners in this dataset, only two report full reclamation of the CBM facilities on their properties. One reports partial reclamation and two report no formal abandonment and reclamation work.

From our interviews, we learned that reclamation completion might be partially dependent on the priorities of the landowner. The two surface owners that reported full reclamation are also the landowners who were the most opportunistic in their approach to reclamation. They preferred that much of the infrastructure (roads, power lines, pipelines) not be reclaimed and instead integrated into their ranching operation. One explained, “One of the [well sites] up here we didn’t reclaim we use for a machinery pad .... Two of them are places the cows for some reason go to bed. And the grass is good. I don’t want it disturbed.”

By being selective about their reclamation priorities, there was a shorter list of necessary reclamation work at these ranches. Arguably, this made it easier for the industry company to clean up these sites promptly as they were manageable, more affordable projects. This is made possible by the fact that these industry operators remained solvent. In contrast, the two landowners that have seen no reclamation work had the most robust requirements regarding reclamation in their agreements. We cannot evaluate whether the stringent terms of the SUDAs necessarily stalled reclamation because these properties were developed by companies that went bankrupt during the boom, orphaning their CBM assets. Despite the lack of reclamation and disregard for terms of their SUDAs, these two landowners retrospectively assessed their overall experience with CBM to be positive.

## 6. Discussion

We argue the results of this research can be understood in three ways: (1) considering matters of scale; (2) acknowledging different paths to satisfaction; and (3) in light of the literature and directions for future research.

First, the status of ‘satisfied surface owner’ is not easy to achieve and is achievable, by some, in the context of Powder River Basin CBM because of matters of scale. The size of properties in this dataset—thousands of acres—reduces the risk of energy development interfering directly with the tasks of the surface owner or agricultural operation. In some instances, due to large ranch size, CBM related activities occurred outside of the surface owners view shed and/or soundscape, especially as construction waned, and production began. Scale posed a challenge for industry that most sampled surface owners were able to view as an opportunity - that of infrastructure construction to facilitate CBM development. The ranchers identified that roads and other built infrastructure could be beneficial to their livestock operations long-term (Haggerty et al., 2018). For the surface owners in our sample, the orphaned wells on their properties are a nuisance, but not debilitating to their agricultural operations. However, this finding should not impede efforts to reclaim wells in a timely and effective manner, as doing so is most affordable and environmentally responsible. Ultimately, the large parcel sizes associated with cattle ranching coupled with the relatively small geographic footprint of CBM wells created a particularly synergistic agriculture-energy overlay in Sheridan County.

Secondly, our analysis illustrates that there is no sole path to satisfaction for surface owners. The data shown in Table 2 underline this fact by highlighting the different characteristics of each of the five highly satisfied landowners. As shown in the table, none share the same profile, reiterating that satisfaction can be achieved using diverse but related strategies.

However, it is important to highlight that surface owners in Wyoming are granted protections and rights to compensation because

**Table 2**  
Characteristics of Satisfied Surface Owners.

Participant	Information Gathering	Level of Input	Monitoring Approach	Status of Reclamation
1	Self-Sufficient	High	Convenience	None
2	Networked	Very High	Active	None
3	Self-Sufficient	Very High	Convenience	Partial
4	Self-Sufficient	Very High	Passive	Completed
5	Networked	Very High	Convenience	Completed

of the 2005 Split Estates Act. Issues arising from early CBM development prompted the passage of this legislation; it was not in place during the first half of the boom. Nonetheless, since unconventional oil and gas drilling is largely regulated on a state-to-state basis (Rabe, 2014), it stands to reason that the presence of this state policy has afforded surface owner’s the ability to achieve greater satisfaction since its enactment. In our sample of surface owners, only one participant directly benefitted from the 2005 Split Estates Act as development on his ranch began in 2006. The remaining four surface owners saw CBM development before 2005, but all still drafted SUDAs that they were ultimately satisfied with, most with the help of an attorney. However, in light of this legislation and despite our findings that most surface owners assessed the benefits of CBM to outweigh costs, there are examples of conflict between CBM operators and surface owners, some escalating to litigation (Paxton Resources L.L.C. v. Brannaman 2004; Pennaco Energy, Inc. v. Sorenson 2016).

Our results have implications based on the literature and directions for future research. Guided by the lifecycle of CBM development, we find that private participation in the exploration phase, specifically SUDA negotiation, and monitoring during the development phase, were most closely linked with eventual satisfaction. Perhaps this could be expected since the SUDA provides ‘instructions’ for how the development will unfold. Nonetheless, this finding supports claims made in the literature by Bugden et al. (2016) that legal contracts are undervalued forms of data for answering questions about the experiences and impacts of unconventional oil and gas development. The authors state that, “the nature of the relationship between lease provisions and aspects of the development process remain fairly opaque to the research community” (Bugden et al., 2016, p. 215). Moreover, like the findings of Jacquet (2015), our data reveals that private participation indeed contributed to split estate surface owners “positive attitudes toward the development” (p. 231). Although this research has furthered scholarly understanding of the leasing process and its influence, more study is needed.

Our results indicate that the finding of Collins and Nkansah (2015) that split estate owners are in a weaker negotiating position does not apply to all surface owners and can be overcome through private participation. This work has affirmed the conclusions reached by Jacquet (2015) regarding how private participation in the planning of energy projects can empower landowners and lead to more satisfactory outcomes. In particular, our study provides evidence that a strong SUDA, regular monitoring and consulting informed legal counsel help to strengthen the position of split estate surface owners. Relatedly, the conclusion made by Malin (2014) that split estate surface owners in West Virginia have “little control over the leasing process” is not ubiquitous across resource plays or geographies. Lastly, our study furthers the conversation of McEvoy et al. (2017) where we find Sheridan County residents are similar to their neighbors to the north, in Eastern Montana, regarding their judgment that, “the economic benefits outweighed the negative impacts” (1) of oil and gas development.

Finally, our findings provide another data point regarding long-term

response to energy development, but here at the individual scale. To that end, surface owners were eager to share three recommendations for those that may face future energy development. First, landowners emphasize the importance of acquiring industry contact information and maintaining an open line of communication. Second, participants believe development should not begin until a strong SUDA is drafted with the help of an experienced attorney. Lastly, interviewees recommend drawing on a network of friends, family, and neighbors and to consult relevant local organizations to learn more about the proposed development. Not only is this an educational exercise but also learning more from friends and neighbors increases the chances of being able to gain leverage in negotiations with industry. Although this advice originates in the Powder River Basin, Wyoming, it stands to reason that aspects of these recommendations will translate across geographies and resource types. Limitations of this sample are clear: this is a select group and we make no claim that this is representative of the experience of CBM development in the Powder River Basin as a whole. Rather, we ask this small, unique dataset to help illuminate the diverse dimensions of the positive experiences that are a part of the complex picture of rural and private support for oil and gas development. Future research will be helpful in deciphering the magnitude and extent of these types of experiences.

## 7. Conclusion

All surface owners, even those with mixed feelings, indicated that they would do CBM over again. Considering that surface owners have been treated largely as unhappy and inferior in the literature, this is an important finding. Despite this view, drawbacks and challenges were mentioned by each landowner in the sample. Nonetheless, our analysis has revealed new insights into underrepresented aspects of the social acceptability of oil and gas. Namely, the critical role of private participation in energy project planning processes and *post facto* perspectives on an energy boom.

This paper reflects on the lifecycle of a CBM boom from the perspective of satisfied surface owners in Sheridan County, Wyoming. This research aims to synthesize the experiences of satisfied surface owners in response to a gap in the literature. By doing so, we have gleaned new understandings about the breadth of experiences with energy development, and how individuals assess development ten years post-bust. Future research is still required, and this study informs that research agenda by suggesting that analysis of oil and gas leases and the role of private participation in the planning of energy projects demand the most scholarly attention.

## Declarations of interest

None.

## Acknowledgment

This work was supported by USDA NIFA [project 2014-05498].

## References

- Allred, B.W., Smith, W.K., Twidwell, D., Haggerty, J.H., Running, S.W., Naugle, D.E., Fuhlendorf, S.D., 2015. Ecosystem services lost to oil and gas in North America. *Science* 348 (6233), 401–402.
- Barrett, C., 2008. Fitting a square peg in a round [drill] hole: the evolving legal treatment of coalbed methane produced water in the Intermountain West. *Yale Law School Leg. Scholarsh. Repos.* 66, 1–77.
- Batley, G.E., Kookana, R.S., 2012. Environmental issues associated with coal seam gas recovery: managing the fracking boom. *Environ. Chem.* 9, 425–428.
- Bleizeffer, D., 2005. Lawsuits Cause Methane Uncertainty. 8 March. *Casper Star Tribune*.
- Bleizeffer, D., 2008. Families Appeal to Supreme Court, Want More Regulation of Coalbed Methane Water. 16 July. *Casper Star Tribune*.
- Boudet, H., Bugden, D., Zanooco, C., Maibach, E., 2016. The effect of industry activities on public support for 'fracking'. *Environ. Politics* 25 (4), 593–612.
- Bridge, G., 2009. Material worlds: natural resources, resource geography and the material

- economy. *Geogr. Compass* 3 (3), 1217–1244.
- Brown, R.B., Dorins, S.F., Krannich, R.S., 2005. The boom-bust-recovery cycle: dynamics of change in community satisfaction and social integration in Delta. *Utah. Rural Soc.* 70 (1), 28–49.
- Bugden, D., Kay, D., Glynn, R., Stedman, R., 2016. The bundle below: understanding unconventional oil and gas development through analysis of lease agreements. *Energy Policy* 92, 214–219.
- Chapman, S.S., Bryce, S.A., Omerik, J.M., Despain, D.G., ZumBerge, J., Conrad, M., 2004. Ecoregions of Wyoming (Color Poster With Map, Descriptive Text, Summary Tables and Photographs). U.S. Geologic Survey, Reston, Virginia (Accessed 15 December 2017). <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8>.
- Collins, A.R., Nkansah, K., 2015. Divided rights, expanded conflict: split estate impacts on surface owner perceptions of shale gas drilling. *Land Econ.* 91 (4), 688–703.
- Crowe, J., Silva, T., Ceresola, R.G., Buday, A., Leonard, C., 2015. Difference in public perceptions and leaders' perceptions on hydraulic fracturing and shale development. *Sociol. Perspect.* 58 (3), 441–463.
- Fisk, J.M., Good, A.J., Nelson, S., 2017. Fueling the boom or smothering it? Examining oil and gas policy differences across states. *Extrac. Indus. Soc.* 4, 869–874.
- Fitzgerald, T., 2010. Evaluating split estates in oil and gas leasing. *Land Econ.* 86 (2), 294–312.
- Freudenburg, W.R., 1992. Addictive economies: extractive industries and vulnerable localities in a changing world economy. *Rural Soc.* 57 (3), 305–332.
- Gilmore, J.S., 1976. Boom towns may hinder energy resource development: isolated rural communities cannot handle sudden industrialization and growth without help. *Science* 191, 535–540.
- Glaser, B.G., Strauss, A.L., 1967. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Publishing Company, Chicago, IL.
- Haggerty, J., McBride, K., 2016. Does local monitoring empower fracking host communities? A case study from the gas fields of Wyoming. *J. Rural Stud.* 43, 235–247.
- Haggerty, J.H., Smith, K.K., Weigle, J., Kelsey, T.W., Walsh, K.B., Coughal, R., Kay, D.L., Lachapelle, P., 2018. Other than that, the income was nice: unconventional oil and gas as balancing act on U.S. farms and ranches. *Energy Res. Soc. Sci.* (accepted, forthcoming).
- Headwaters Economics, 2018. A Profile of Land Use: Sheridan County, Wyoming. Generated via EPS-HDT online. (Accessed 3 January 2018). <https://headwaterseconomics.org/tools/economic-profile-system/>.
- Jacquet, J., 2014. Review of risks to communities from shale energy development. *Environ. Sci. Technol.* 48 (15), 8321–8333.
- Jacquet, J., 2015. The rise of 'private participation' in the planning of energy projects in the rural United States. *Soc. Nat. Resour.* 28 (3), 231–245.
- Jacquet, J., Witt, K., Rifkin, W., Haggerty, J.H., 2018. A complex adaptive system or just a tangled mess? Property rights and shale gas governance in Australia and the U.S. In: Whitton, Cotton, Brasier (Eds.), *Governing Shale Gas*. Routledge July.
- James, A., Aadland, D., 2011. The curse of natural resources: An empirical investigation of U.S. counties. *Resour. Energy Econ.* 33 (2), 440–453.
- Jones, K.P., Welborn, J.F., Russell, C.J., 2013. Split estates and surface access issues. *Landman's Legal Handbook: A Practical Guide to Mineral Leasing*. Rocky Mountain Mineral Law Foundation, pp. 181–196.
- King, J., 2014. Wyoming's Political Culture: Our Own but Not Unique. 18 February. *Wyofile* (Accessed 24 April 2018). <https://www.wyofile.com/wyomings-political-culture-unique/>.
- Krannich, R., 2017. Déjà vu...or something new? Community impacts of 21st century energy development through the lens of 'boom town disruption' studies. Plenary Lecture at 2017 Energy Impacts Symposium, Energy Impacts Coordination Network.
- Kreuze, A., Schelly, C., Norman, E., 2016. To track or not to track: perceptions of the risks and opportunities of high-volume hydraulic fracturing in the United States. *Energy Res. Soc. Sci.* 20, 45–54.
- Kulander, C.S., 2009. Surface damages, site remediation and well bonding in Wyoming – results and analysis of recent regulations. *Wyo. Law Rev.* 9 (3), 413–453.
- Malin, S., 2014. There's no real choice but to sign: neoliberalization and normalization of hydraulic fracturing on Pennsylvania farmland. *J. Environ. Stud. Sci.* 4 (1), 17–27.
- McEvoy, J., Gilbert, S.J., Anderson, M.B., Ormerod, K.J., Bergmann, N.T., 2017. Cultural theory of risk as a heuristic for understanding perceptions of oil and gas development in Eastern Montana, USA. *Extrac. Indus. Soc.* 4, 852–859.
- Micheli, M., 2006. Showdown at the OK Corral: Wyoming's challenges to U.S. supremacy on federal split estate lands. *Wyo. Law Rev.* 6, 31–51.
- Nghiem, L.D., Ting, R., Aziz, N., Porter, L., Regmi, G., 2011. Treatment of coal seam gas water for beneficial use in Australia: a review of best practices. *Desal. Water Treat.* 32, 316–332.
- Rabe, B.G., 2007. Environmental policy and the Bush era: the collision between the administrative presidency and state experimentation. *Publ. J. Fed.* 37 (3), 413–431.
- Rabe, B.G., 2014. Shale play politics: the intergovernmental odyssey of American shale governance. *Environ. Sci. Technol.* 48 (15), 8369–8375.
- Ryder, S.S., Hall, P.M., 2017. This land is your land, maybe: a historical institutionalist analysis for contextualizing split estate conflicts in U.S. unconventional oil and gas development. *Land Use Policy* 63, 149–159.
- Sovacool, B.K., Burke, M., Baker, L., Kotikalapudi, C.K., Wlokas, H., 2017. New frontiers and conceptual frameworks for energy justice. *Energy Policy* 105, 677–691.
- Storow, B., 2015. After High Plains Gas: Wyoming Contemplates the Next Step in Coalbed Methane Cleanup. 12 August. *Casper Star Tribune*.
- Straube, M., Holland, M., 2003. A Conflict Assessment of Split Estate Issues and a Model Agreement Approach to Resolving Conflicts Over Coalbed Methane Development in the Powder River Basin. Report prepared for the U.S. Institute for Environmental Conflict Resolution.
- Tanoh, D.A., 2016. The Exploration and Production Life Cycle of Oil and Gas. June 29.



- Reporting Oil and Gas (Accessed 24 April 2018). <http://www.reportingoilandgas.org/the-exploration-and-production-life-cycle-of-oil-and-gas/>.
- Thakur, P., Schatzel, S., Aminian, K., 2014. Coalbed Methane: From Prospect to Pipeline. Elsevier, San Diego, CA.
- Trainor, A.M., McDonald, R.I., Fargione, J., 2016. Energy sprawl is the largest driver of land use change in United States. *PLoS One* 11 (9), 1–16.
- U.S. Census Bureau, 2016. Quickfacts: Sheridan County, Wyoming. (Accessed 21 November 2017). <https://www.census.gov/quickfacts/fact/table/sheridancountywyoming,WY/PST045216>.
- U.S. Census of Agriculture, 2012. Table 8. Farms, Land in Farms, Value of Land and Buildings, and Land Use: 2012 and 2007. (Accessed 27 April 2018). [https://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Volume\\_1\\_Chapter\\_2\\_County\\_Level/Wyoming/st56\\_2\\_008\\_008.pdf](https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1_Chapter_2_County_Level/Wyoming/st56_2_008_008.pdf).
- U.S. Department of the Interior, n.d. Natural Resources Revenue Data: Wyoming. <https://revenue.data.doi.gov/explore/WY/> (Accessed 15 December 2017).
- U.S. Energy Information Administration, 2017. Wyoming State Profile and Energy Estimates. (Accessed 15 December 2017). <https://www.eia.gov/state/?sid=WY>.
- Walsh, K.B., 2017. Split estate and Wyoming's orphaned well crisis: the case of coalbed methane reclamation in the Powder River Basin, Wyoming. *Case Stud. Environ.* 1–8.
- Wescoat, J., 1987. The practical range of choice in water resources geography. *Prog. Hum. Geogr.* 11 (1), 41–59.
- Western, S., 2002. Pushed Off the Mountain, Sold Down the River: Wyoming's Search for Its Soul. Homestead Publishing, Moose, WY.
- Wyoming Oil and Gas Conservation Commission, 2017a. CBM] Wells by County. (Accessed 27 November 2017). <http://wogcc.state.wy.us/countapd.cfm>.
- Wyoming Oil and Gas Conservation Commission, 2017b. Orphaned Wells We Are Tracking. (Accessed 4 December 2017). <http://wogcc.state.wy.us/OrpanWells.cfm>.
- Wyoming Statute Annotated § 30-5-4, 2016. Entry to Conduct Oil and Gas Operations. (Accessed 28 November 2017). <https://law.justia.com/codes/wyoming/2016/title-30/chapter-5/article-4/>.